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Migration and Capital Accumulation: Evidence from Rural Mexico

Vera Chiodi* Esteban Jaimovich† Gabriel Montes-Rojas‡

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Abstract

This paper studies the link between migration, remittances and productive assets accumulation for a panel of poor rural households in Mexico over the period 1997-2006. In a context of financial markets imperfections, migration may act as a substitute for imperfect credit and insurance provision (through remittances from migrants) and, thus, exert a positive effect on investment. However, it may well be the case that remittances are channelled towards increasing consumption and leisure goods. Exploiting within family variation and an instrumental variable strategy, we show that migration indeed accelerates productive assets accumulation. Moreover, when we look at the effect of migration on consumption of non-productive assets (durable goods), we find instead a negative effect. Our results then suggest that poor rural families resort to migration as a way to mitigate constraints that prevent them from investing in productive assets.

JEL Classification: O15, D31, J24, R23, F22.

Key Words: Migration; Remittances; Capital Accumulation; Rural Poverty.

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1 Introduction

The migration of labor out of agriculture was a fundamental issue in the early models of development economics (Lewis, 1954; Sen 1966; Harris and Todaro, 1970; see Ghatak, Levine and Wheatly Price, 1996, for an excellent survey). In these models, the agricultural sector is typically characterized by stagnation and unproductive labor, while the urban industrial sector is the one that contributes to economic development. The above literature has then seen migration from the rural to the urban sector as a way out of poverty. However, some recent work has argued for a positive role of migration also in the rural sector itself. In general, migration and remittances may alleviate credit and productive constraints (Rozelle, Taylor and DeBrauw, 1999). For instance, Stark (1991) hypothesizes that migrants may play the role of financial intermediaries, enabling rural households to overcome credit constraints and missing insurance markets. Furthermore, migration mitigates the impact of agricultural income shocks by allowing families to relocate labor to the cities when that is needed (Lucas and Stark, 1985). In fact, it is often the case that individuals in a household commonly pool resources to finance migration of one of their members who later on repays this investment by remitting a part of his/her income back to the family. Thus, households tend to spread their labor force over different geographic markets in order to better pool risks. In addition, consistent with the previous observations, Glytsos (1993) and Giuliano and Ruiz-Arranz (2009) provide evidence that remittances tend to particularly foster growth in countries with less developed financial systems by helping overcome liquidity constraints.

The research question addressed in this paper is to assess the effect of migration on the process of asset accumulation at a microeconomic level using household data from poor rural areas in Mexico. We differentiate by the *types* of assets that are accumulated, i.e. productive vs. non-productive assets, and we focus on the role played by remittances to help assets accumulation. The accumulation of assets by rural households plays a crucial role in the analysis of rural poverty and it is an under-explored area of the migration-welfare links operating through remittances from migrants.

In Mexico, rural areas have a very high incidence of deprivation in terms of access to services and perceived well-being. In this context, migration may exert a positive effect on asset accumulation and lift families permanently out of poverty in an overall deprived context. However, it may well be the case that the impact is not positive if accumulation is biased towards leisure goods, which may increase current welfare of the migrant families but decrease their dynamic prospects. Using a unique panel database for Mexican rural households, the econometric results presented in this paper show that migration indeed opens up a possibility for poor households to accelerate asset accumulation, particularly in productive assets. We deploy an instrumental variable strategy in order to cope with endogeneity issues.

We frame the empirical results within a two-period model of investment and migration decisions of credit constrained rural households. The model shows that migration affects investment only for moderately poor households, while it leads to increasing consumption for the very poor and relatively rich households. Moreover, the model makes it explicit that household characteristics need to be controlled for in the empirical setting in order to obtain unbiased results of the effect of migration on investment. More precisely, the model shows that migration decisions correlate with household-specific characteristics that also influence migration and investment choices. Controlling for these household-specific characteristics is then crucial for insulating the effect of sending out a migrant on the investment behavior of those who remain at the rural village. Interestingly, the predicted bias in the theoretical model goes in the same direction as that in our empirical results.

Migration and remittances have been largely studied in the microeconometric literature with respect to the accumulation of human capital. As argued in Hanson and Woodruff (2003) the additional income from remittances may allow children to delay entering the work force. However, it may also alter the family structure, increasing child-rearing responsibilities and, therefore, having a negative consequence on household welfare. Moreover, as argued in Acosta (2006), it can be expected that recipient families will expand their consumption of leisure (and reduce labor supply) and that recipient families may increase their dependence on external transfers. Nevertheless, evidence on the accumulation of physical assets is still missing in this literature and this paper intends to fill this gap.

The topic addressed here is also related to the effect of credit constraints in the urban informal sector. Woodruff (2001) found a positive impact of remittances in Mexico (they are shown to be responsible for almost 20% of the capital invested). In the same vein, Mesnard and Ravaillon (2002) and Mesnard (2004) studied the temporary migration decision of workers who are credit constrained in Tunisia and evaluates the extent to which liquidity constraints affect self-employment decisions of returned migrants. There is also some evidence on this issue for the case of internal migration in India (Banerjee and Bucci, 1994). Our paper extends these results to rural poor households.

This paper is organized as follows. Section 2 presents a model that accounts for migration and investment decisions. Section 3 describes the unique dataset used to construct the panel of rural households. Section 4 presents the methodology used for constructing the asset indexes. Section 5 presents some descriptive statistics. Section 6 carries the econometric analysis showing the effect of migration on asset accumulation. Section 7 concludes.

2 Migration and investment decisions in a two-period maximization problem

This section proposes a very simple model to illustrate how relatively poor families may resort to migration as a response to credit constraints that prevent them from investing in productive assets. In particular, the model aims to show that poor families may, under certain conditions, choose to send migrants so as to use their remittances to overcome credit constraints.

We will first start with a two-period model in which the possibility of sending migrants is excluded. This will set a benchmark upon which we can then compare the optimal behavior of families when they have the chance to send a migrant to a richer region or city, from whom they may receive positive remittances.

2.1 No-migration regime

There is a continuum of rural families (or households) $i \in \mathcal{I}$ who live for two periods, $t = \{1, 2\}$. At the beginning of each period t each family i receives an amount of income equal to $y_{t,i}$, where $y_{t,i}$ is the realisation of a random variable uniformly distributed (and independently distributed across families) along the interval $[1, \overline{y}]$, where $\overline{y} > 1$. We assume that $y_{1,i} = y_{2,i} = y_i$; that is, income realizations are persistent within families. More broadly speaking, we could also interpret the variable y_i as capturing the effect of family specific productive assets (for example, different families may own plots of land that differ in terms of their level of fertility); in the econometric terminology used below, the variable y_i captures family-specific fixed-effects.

Families derive log-utility from consumption at the end of each period t and we assume no discount factor is applied on future consumption.[1] All families are credit-constrained, and then, they cannot increase current consumption by borrowing against future income. Families, however, have access to a storing technology (with no depreciation), hence they may transfer present income to the future in case they wish so.

All families have access also to an indivisible investment project (an investment in productive assets that increases productivity in the future, for example, investing in irrigation or buying a new tractor). In particular, in period 1 families can choose whether or not to invest in a project that requires 1 unit of capital as investment, and yields $R > 1$ units of income at the end of period 2.

The families' optimization problem may be approached by noting that it involves two different issues: first, choosing whether or not to invest in the project at the beginning

[1]No discounting is just a simplifying assumption, useful for the algebraic derivations. The log-utility is also mainly for algebraic simplicity, and could be replaced by any other CRRA utility function without much problem (as we will see below, it is important though that utility displays decreasing absolute risk aversion).

of $t = 1$; second, choosing the optimal consumption flow, conditional on the former investment decision. We can then solve the problem for family i simply by comparing the maximum utility achieved in each of the two possible scenarios: (a) investing in the project; (b) not investing. We denote by $c_{t,i}$ consumption in period t and by $s_{1,i}$ the amount of income stored from period 1 until period 2.

Case (a): Invest in the project. Family i solves:

$$\begin{aligned} \max \quad &: \quad U_{i,I} = \ln(c_{1,i}) + \ln(c_{2,i}) \\ &\text{subject to:} \quad c_{1,i} = y_i - s_{1,i} - 1, \\ &\qquad\qquad\qquad c_{2,i} = y_i + s_{1,i} + R, \\ &\qquad\qquad\qquad s_{1,i} \geq 0. \end{aligned} \tag{1}$$

It is straightforward to observe that in problem (1) the constraint $s_{1,i} \geq 0$ will bind in the optimum (i.e., families would like to borrow against future income so as to smooth consumption, but they are not able to do so). Hence, families will set optimally $s^*_{1,i} = 0$, implying that: $c^*_{1,i,I} = y_i - 1$ and $c^*_{2,i,I} = y_i + R$. As a result, the maximum utility achieved by a family with income y_i that invests in the project is given by:

$$U^*_{i,I} = \ln(y_i - 1) + \ln(y_i + R). \tag{2}$$

Case (b): No investment. Family i solves:

$$\begin{aligned} \max \quad &: \quad U_{i,NI} = \ln(c_{1,i}) + \ln(c_{2,i}) \\ &\text{subject to:} \quad c_{1,i} = y_i - s_{1,i}, \\ &\qquad\qquad\qquad c_{2,i} = y_i + s_{1,i}, \\ &\qquad\qquad\qquad s_{1,i} \geq 0. \end{aligned} \tag{3}$$

Since the income flow is identical in both periods and future is not discounted, families will optimally consume the y_i in each of the two periods, so as to achieve perfect consumption smoothing. That is, $c^*_{1,i,NI} = c^*_{2,i,NI} = y_i$, which in turn implies $s^*_{1,i,NI} = 0$. Hence, the utility achieved by a family with income y_i that decides *not* to invest is given by:

$$U^*_{i,NI} = \ln\left(y_i^2\right). \tag{4}$$

Finally, families will choose to invest if and only if that allows them to obtain higher intertemporal utility than not investing. Then, comparing (2) and (4) implies:

$$I = 1 \quad \Leftrightarrow \quad y_i > \frac{R}{R-1}. \tag{5}$$

The expression (5) stipulates that only families with (permanent) income larger than $R/(R-1)$ will invest in the project. The reason for this is that, in the presence of credit constraints, given that utility displays decreasing absolute risk aversion, only sufficiently rich families are willing to give away one unit of consumption in $t = 1$ in order to be able to invest and increase consumption $t = 2$ by R units.[2] Henceforth, we assume that $\overline{y} > R/(R-1)$, so that there exist some families who are willing to invest.

2.2 Migration allowed

Assume now that after observing the income realization y_i at the beginning of $t = 1$, family i could send one of their members to a richer city or region in the first period (we assume for simplicity only temporary migration). Sending a migrant imposes an "emotional" cost $M > 0$, measured in terms of utility.[3] Migration is treated as a risky asset when compared with the risk-free income in the village. The migrant may get a *good job* in the region he migrated to, which yields net income $\upsilon > 0$. Instead, if migrant fails to find a good job, he receives net income equal to 0. We assume that $1 \leq \upsilon < 1 + R$.[4] Furthermore, we suppose that the emotional cost is not too large relative to the potential gains from migration; in particular, $M \leq \ln(R)$.

[2]There is no risk in the model. Hence, the DARA property should be simply understood as an assumption on the degree of concavity of the utility function, which in turn governs the intertemporal elasticity of substitution, and therefore how willing agents are to transfer resources across the two periods.

[3]In the literature this is known as "psychological costs", and there exists some evidence for intra-European migration (Molle and van Mourik, 1988). We could also add to the model some pecuniary cost attached to sending a migrant (i.e. transportation costs), although it is important for our argument that the expected pecuniary return from sending a migrant is positive.

[4]The lower bound, $\upsilon \geq 1$, essentially says that the good jobs that migrants may find are sufficiently productive, making migration (possibly) an attractive option. The upper bound, $\upsilon < 1 + R$, is just posed to focus only on those cases in which the credit constraint, $s_i \geq 0$, binds in the optimum (as we will see, $\upsilon < 1 + R$ implies that total family income in $t = 1$ never exceeds that of $t = 2$).

We assume that local networks in the city where migrants move to make it easier for them to obtain a good job.[5] In particular, we postulate that the migrant from family i will manage to find good job with probability $p(n_i) = n_i$, where $n_i \in [0, 1]$ represents the 'network density' that family i has got in the recipient city. We assume that n_i is uniformly distributed along the interval $[0, 1]$ in the population, and that the correlation between n_i and y_i in the population equals zero.

From now onwards we denote by $\widetilde{U}_i^*$ the utility achieved by family i if they choose to send a migrant (whereas, as before, U_i^* denotes the utility of family if they do not send a migrant).

Relatively rich families: Consider family i with network density $n_i \in [0, 1]$ and income $y_i \geq R/(R-1)$. From the previous analysis, it follows that this family will *always* invest in the project. That is, it will invest regardless of whether it chooses to send a migrant or not, and, in the case they do send a migrant, regardless of whether the migrant finds a good job or not. As a result, if they do not send a migrant, their utility equals that written before in (2). On the other hand, if they do send a migrant, their utility is given by:

$$\widetilde{U}_{i,I}^{*,rich} = n_i \left[\ln(y_i + \upsilon - 1) + \ln(y_i + R)\right] + (1 - n_i)\left[\ln(y_i - 1) + \ln(y_i + R)\right] - M. \quad (6)$$

A family with $y_i \geq R/(R-1)$ will thus send a migrant if and only if $\widetilde{U}_{i,I}^{*,rich} > U_{i,I}^*$, which in turn leads to:

$$\text{If } y_i \geq R/(R-1)\,, \text{ send migrant iff: } \quad n_i \left[\ln(y_i + \upsilon - 1) - \ln(y_i - 1)\right] \geq M. \quad (7)$$

Relatively poor families: Consider now the case of family i with $n_i \in [0, 1]$ and $y_i < R/(R-1)$. From the previous analysis, it follows that such a family will not invest in the project if, after sending a migrant, this migrant fails to obtain a good job. Nor will

[5]The role of networks on migration has been extensively studied in the literature (see for instance Munshi, 2003, and the references therein).

they invest in the project when they do not send a migrant, as this situation is isomorphic to the no-migration regime.

The first question to address is then the following: should a family that sent a migrant invest in the project when the migrant obtains a good job? Consider such a family: the two expressions below show the utility achieved by the family, first, in the case it invests in the project and, second, in the case it does not.

$$\widetilde{U}_{i,I}^{*,poor} = n_i \left[\ln\left(y + \upsilon - 1\right) + \ln(y + R)\right] + (1 - n_i)\left[\ln\left(y_i^2\right)\right] - M, \tag{8}$$

$$\widetilde{U}_{i,NI}^{*,poor} = n_i \left[\ln\left(y_i + \frac{\upsilon}{2}\right)^2\right] + (1 - n_i)\left[\ln\left(y_i^2\right)\right] - M. \tag{9}$$

Hence, comparing (8) and (9), it follows that families with $y_i < R/\left(R-1\right)$ who send a migrant will invest in the project, if and only if the migrant finds a good job *and* the following condition holds:

$$y_i > \frac{R}{R-1} - \frac{\upsilon\left(R - \frac{\upsilon}{4}\right)}{R-1} \equiv \widehat{y}. \tag{10}$$

Notice that $\widehat{y} < \frac{R}{R-1}$. In fact, it may well be that $\widehat{y} < 1$.[6]

The second question to deal with is, bearing in mind equations (8) and (9), should a family with $n_i \in [0,1]$ and $y_i < R/\left(R-1\right)$ send a migrant or not? Answering this question demands comparing $U_{i,NI}^*$ to $\widetilde{U}_{i,I}^{*,poor}$ for those families with $y_i \in \left(\widehat{y}, \frac{R}{R-1}\right)$, whereas for those families whose $y_i \leq \widehat{y}$ we must compare $U_{i,NI}^*$ to $\widetilde{U}_{i,NI}^{*,poor}$. We can thus obtain the following two conditions:

$$\text{If } y_i \in \left(\widehat{y}, \frac{R}{R-1}\right), \text{ send migrant iff: } n_i \left[\ln\left(y_i + \upsilon - 1\right) + \ln(y_i + R) - \ln\left(y_i^2\right)\right] \geq M, \tag{11}$$

$$\text{If } y_i < \widehat{y}, \text{ send migrant iff: } n_i \left[\ln\left(y_i + \frac{\upsilon}{2}\right)^2 - \ln\left(y_i^2\right)\right] \geq M. \tag{12}$$

[6] For example, for any $R > \frac{5}{4}$, $\widehat{y}$ will necessarily be strictly smaller than 1. To see this, observe from (10) that $\upsilon < 1 + R$ implies $\widehat{y}$ is strictly decreasing in υ, hence $\widehat{y}$ reaches a maximum at the lower bound $\upsilon = 1$. Replacing then $\upsilon = 1$ into (10) straightforwardly leads to the fact that $R > \frac{5}{4}$ implies $\widehat{y} < 1$. More generally, $\widehat{y} < 1$ whenever $R \geq \upsilon^{-1} + \frac{\upsilon}{4}$. Notice, too, that both a larger R and larger υ make this last inequality more likely to hold. This is quite intuitive, since the (expected) return from migration is increasing in R and υ; in the former case indirectly through investment returns, in the latter directly through earnings.

Since a larger network, n_i, increases the chances the migrant finds a good job (or, in other words, the expected return from sending a migrant increases with n_i), families with a larger n_i will naturally tend to be more prone to send a migrant. The following proposition states this result more formally.

Proposition 1 *There exists a continuous and strictly increasing function* $\widetilde{n}(y) : \mathbb{R}_{++} \to \mathbb{R}_{++}$*, such that for all* $n_i \geq \widetilde{n}(y_i)$ *:*

(i) If $y_i \in \left[\frac{R}{R-1}, \overline{y}\right]$*, then condition (7) holds.*

(ii) If $y_i \geq 1$ *and* $y_i \in \left(\widehat{y}, \frac{R}{R-1}\right)$*, then condition (11) holds.*

(iii) If $y_i \geq 1$ *and* $y_i \leq \widehat{y}$*, then condition (12) holds.*

Furthermore, $0 < \widetilde{n}\left(\frac{R}{R-1}\right) < 1$.

Proof. In Appendix. ■

Proposition 1 states that, for each family i with income $y_i \in [1, \overline{y}]$, there exists a threshold in the network density, $\widetilde{n}(y_i)$, such that if $n_i \geq \widetilde{n}(y_i)$ this family chooses to send a migrant. The network threshold $\widetilde{n}(y)$ is strictly increasing in y, implying that a larger mass of migrants will originate from relatively poor families than from relatively rich ones. The intuition for this is that the marginal utility of consumption is decreasing in the level of consumption, while the disutility from migration, M, is constant for any level of consumption. As a result, poorer families will be more eager to endure the "emotional" cost M, because their marginal return of migration in terms of (expected) utility of additional consumption is larger. Notice, finally, that Proposition 1 does not restrict $\widetilde{n}(y_i) \leq 1$ for $y_i > R/(R-1)$. In fact, it may well be the case that none of the families with $y_i > R/(R-1)$ will send any migrants.

The next step is to study how migration decisions interact with investment decisions. In particular, we are interested in studying whether families send migrants with the aim to increase their capacity to invest in the projects. By merging the migration results in Proposition 1 with the preceding discussion in this section, we can summarize households' optimal decisions concerning migration and investment in the following corollary.

Corollary 1

(i) *If* $R \geq \upsilon^{-1} + \frac{\upsilon}{4}$. *Then* $\widehat{y} \leq 1$, *and:*

a) For any $y \in \left[\frac{R}{R-1}, \overline{y}\right]$*: If* $n_i \geq \widetilde{n}(y)$ *and* $y_i = y$, *family* i *sends a migrant. If* $n_i < \widetilde{n}(y)$ *and* $y_i = y$, *family* i *does not send a migrant. Family* i *always invests in the project.*

b) For any $y \in \left[1, \frac{R}{R-1}\right)$*: If* $n_i \geq \widetilde{n}(y)$ *and* $y_i = y$, *family* i *sends a migrant and invests in the project if and only if the migrant finds a good job. If* $n_i < \widetilde{n}(y)$ *and* $y_i = y$, *family* i *does not send a migrant and does not invest in the project.*

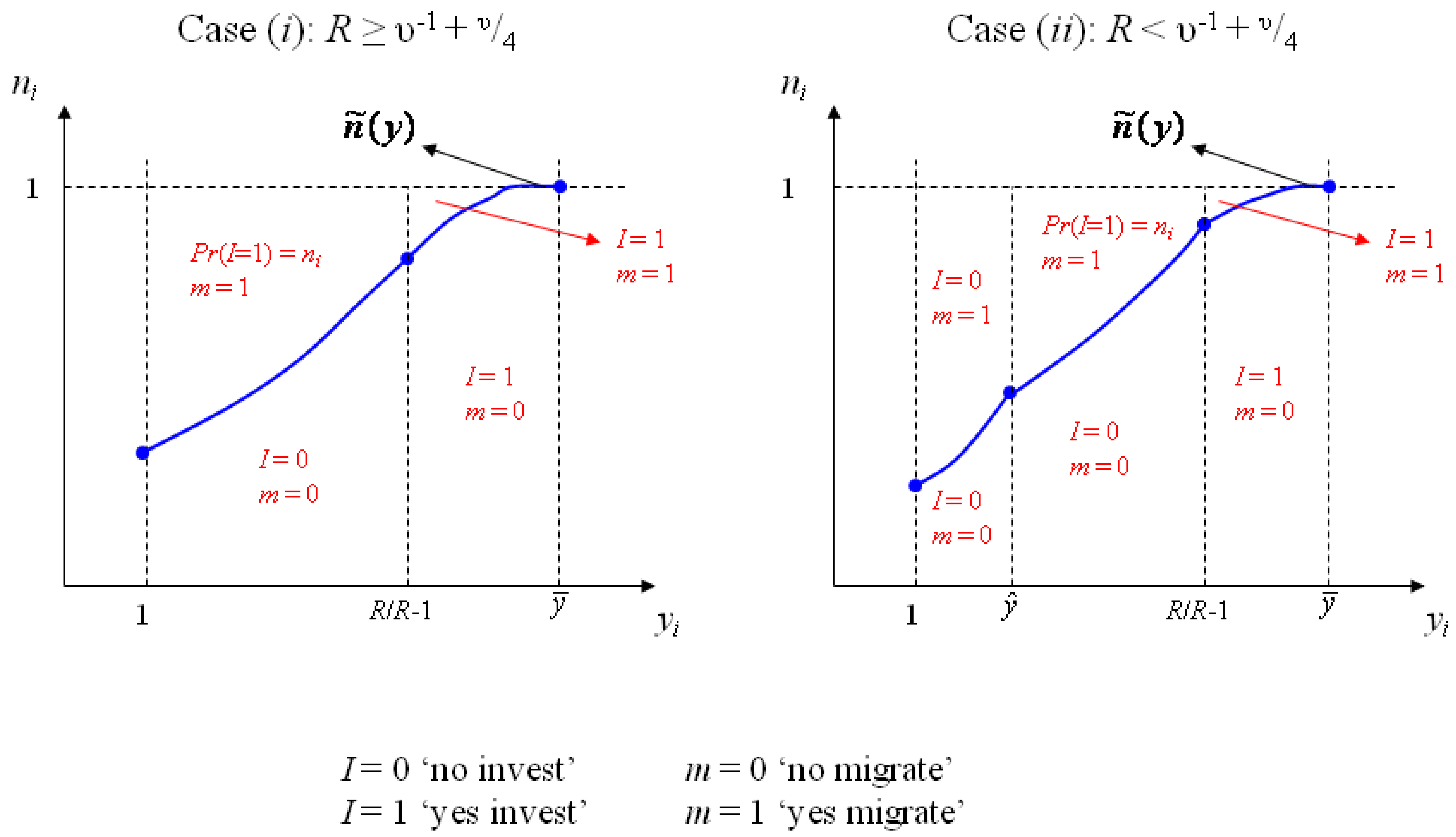
(ii) *If* $R < \upsilon^{-1} + \frac{\upsilon}{4}$. *Then* $\widehat{y} > 1$, *and:*

a) For any $y \in \left[\frac{R}{R-1}, \overline{y}\right]$*: If* $n_i \geq \widetilde{n}(y)$ *and* $y_i = y$, *family* i *sends a migrant. If* $n_i < \widetilde{n}(y)$ *and* $y_i = y$, *family* i *does not send a migrant. Family* i *always invests in the project.*

b) For any $y \in \left(\widehat{y}, \frac{R}{R-1}\right)$*: If* $n_i \geq \widetilde{n}(y)$ *and* $y_i = y$, *family* i *sends a migrant and invests in the project if and only if the migrant finds a good job. If* $n_i < \widetilde{n}(y)$ *and* $y_i = y$, *family* i *does not send a migrant and does not invest in the project.*

c) For any $y \in [1, \widehat{y}]$*: If* $n_i \geq \widetilde{n}(y)$ *and* $y_i = y$, *family* i *sends a migrant. If* $n_i < \widetilde{n}(y)$ *and* $y_i = y$, *family* i *does not send a migrant. Family* i *never invests in the project.*

Figure 1: Migration and investment decisions



The results from Corollary 1 can be visually summarized in Figure 1. The key insight of the corollary can be gleaned from point b), both for cases (i) and (ii) therein. The result in b) says there exist some families who use migration as a mechanism to mitigate credit constraints that prevent them from investing in projects that would raise their intertemporal income. Essentially, those families send a migrant, betting on the chance that this migrant finds a good job, which would increase their total income in $t = 1$ and, thus, puts them in better position to undertake the unit investment that yields $R > 1$ units of income in $t = 2$.

2.3 Effect of migration on investment decisions

We now study the effect of migration on families' investment decisions. The migration effect results from calculating the difference in investment decisions between migrant and non-migrant families. First consider $E\left[I|\, m=1, y\right] - E\left[I|\, m=0, y\right]$, where I and m are indicator functions regarding investment and migration decisions, respectively. In relation to the empirical results in this paper, we refer to this model as fixed-effects (FE) model, because by conditioning on y we are controlling for the family-specific FE. Note from Corollary 1 that, for any $y \geq \frac{R}{R-1}$, families choose $I = 1$ irrespective of their migration choice; while (in case (ii) of the corollary), for $y < \widehat{y}$, families always set $I = 0$, regardless of their migration choices. It follows then that migration has only an effect on the investment behavior of families with $\widehat{y} \leq y < \frac{R}{R-1}$; in particular:

$$\begin{aligned} E\left[I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right] - \underbrace{E\left[I|\, m=0, \widehat{y} \leq y < \tfrac{R}{R-1}\right]}_{=0} \\ = E\left[I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right] > 0. \end{aligned} \tag{13}$$

Equation (13) makes it explicit that migration exerts a positive effect on investment decisions. However, notice that a key feature of the problem is the fact that intrinsic family characteristics need to be taken into account when evaluating the effect of migration on investment. In fact, if those characteristics are not controlled for, the measured effect of migration on investment may turn out to be incorrect, because by simply comparing the average behavior of families with and without migrants, we may also be capturing the influence of other variables that somehow correlate with migration decisions.

To make this last argument more precise, consider now the overall association between migration and investment in the population; this results from calculating the difference, $E[I|m=1]-E[I|m=0]$. In parallel with the empirical results, we refer to this model as ordinary least-squares (OLS) effect. After some algebra we obtain

$$\begin{aligned} E[I|m=1]-E[I|m=0] = {} & \underbrace{\Pr\left[\widehat{y}<y<\tfrac{R}{R-1}\middle| m=1\right]\cdot E\left[I\middle| m=1,\widehat{y}<y<\tfrac{R}{R-1}\right]}_{\text{positive}}+ \\ & \underbrace{\left\{\Pr\left[y\geq\tfrac{R}{R-1}\middle| m=1\right]-\Pr\left[y\geq\tfrac{R}{R-1}\middle| m=0\right]\right\}}_{\text{negative}}, \end{aligned} \tag{14}$$

where $\Pr\left[y\geq\frac{R}{R-1}\middle| m=1\right]<\Pr\left[y\geq\frac{R}{R-1}\middle| m=0\right]$ follows from the fact that the threshold-function $\widetilde{n}(y)$ is monotonically increasing in y.

The first thing that can be observed from (14) is that it is no longer true that families with migrants tend to invest more than families without migrants; that is, $E[I|m=1]-E[I|m=0]\lesseqgtr 0$. Furthermore, we can also show that OLS effect is always smaller that the FE effect. We refer to this difference as the OLS bias.

Proposition 2 *The OLS bias is negative, that is:*

$$[E(I|m=1)-E(I|m=0)]-\left[E\left(I|m=1,\widehat{y}\leq y<\tfrac{R}{R-1}\right)-E\left(I|m=0,\widehat{y}\leq y<\tfrac{R}{R-1}\right)\right]<0 \tag{15}$$

Proof. Note: The following proof is conducted for the case in which $\widehat{y}\leq 1$. The proof for the case in which $\widehat{y}>1$ is almost identical to this one, and it is available from the authors upon request.

The expression (15) can be re-ordered as follows:

$$\begin{aligned} \text{OLS bias} = {} & \underbrace{\left[E\left(I|m=0,\widehat{y}\leq y<\tfrac{R}{R-1}\right)-E(I|m=0)\right]}_{A} \\ & -\underbrace{\left[E\left(I|m=1,\widehat{y}\leq y<\frac{R}{R-1}\right)-E(I|m=1)\right]}_{B}. \end{aligned} \tag{16}$$

Recalling (13), we can observe that the first member of (16) simplifies to:

$$A=0-\Pr\left[y\geq\tfrac{R}{R-1}\middle| m=0\right]=-\Pr\left[y\geq\tfrac{R}{R-1}\middle| m=0\right].$$

In the case of the second member of (16), we have:

$$\begin{aligned} B &= E\left(I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right) - \Pr\left(\widehat{y} \leq y < \tfrac{R}{R-1} \middle|\, m=1\right) E\left(I \,\middle|m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right) \\ &\qquad - \Pr\left(y \geq \tfrac{R}{R-1} \middle|\, m=1\right) \\ &= E\left(I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right) \underbrace{\left[1 - \Pr\left(\widehat{y} \leq y < \tfrac{R}{R-1} \middle|\, m=1\right)\right]}_{\Pr\left(y \geq \frac{R}{R-1} \middle| m=1\right)} - \Pr\left(y \geq \tfrac{R}{R-1} \middle|\, m=1\right) \\ &= -\Pr\left(y \geq \tfrac{R}{R-1} \middle|\, m=1\right) \left[1 - E\left(I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right)\right] \end{aligned}$$

Therefore, we can in the end obtain:

$$A - B = -\Pr\left[y \geq \tfrac{R}{R-1} \middle|\, m=0\right] + \Pr\left(y \geq \tfrac{R}{R-1} \middle|\, m=1\right) \left[1 - E\left(I|\, m=1, \widehat{y} \leq y < \tfrac{R}{R-1}\right)\right]$$

which is always strictly negative for the combined effect of the following two properties: 1) The monotonicity of $\widetilde{n}(y)$ implies that: $\Pr\left(y \geq \frac{R}{R-1} \middle|\, m=0\right) > \Pr\left(y \geq \frac{R}{R-1} \middle|\, m=1\right)$. 2) The fact that $E\left(I|\, m=1, \widehat{y} \leq y < \frac{R}{R-1}\right) < 1$. This is because, among the families with $\widehat{y} \leq y < R/(R-1)$ and send migrants, only in those cases in which the migrant manages to find a good job (which occurs with probability n_i) do families invest in the project. ■

The OLS bias arises because the OLS regression underestimate the effect of migration on investment. This occurs because the family-specific level of income (y_i) and the migration decision cannot be separated. In consequence, it is important to control for the level of income y_i or other family-specific characteristics to get an unambiguous effect.

3 Data

We make use of a unique new dataset available for Mexico that we consider representative of the extreme rural poor. The data was collected for administrative purposes by the Oportunidades (ex Progresa) program.[7] Thanks to retrospective information, we

[7] Launched in Mexico in 1997, it is a program whose main aim is to improve the process of human capital accumulation in the poorest communities by providing conditional cash transfers on specific types of behavior in three key areas: nutrition, health and education. Nevertheless, these households are also targeted by other social programs.

managed to construct a panel of households based on three surveys. In December 2006, the Instituto Nacional de Salud Pública conducted a survey[8] of recipient households in the rural localities where the *Oportunidades* program started in 1997 with a 10% random sample, stratified by state. This database is then matched to another survey, the ENCASEH (Encuesta de Caracteristicas Socioeconomicas de los Hogares), carried out in 1997 and 1998, and to the ENCRECEH (Encuesta de Recertificación de los Hogares) carried out in 2001. This allows us to build a balanced panel database composed of three time observations (1997, 2001 and 2006) for 4,365 households from 130 rural localities.

This constructed database includes detailed information on each beneficiary household, including household demographics, income level and sources, education and several types of assets. It also includes locality-level data, mainly regarding infrastructure. Given the risk of attrition bias in our estimation, we compared the distributions between the balanced panel of 4,365 and the unbalanced panel. The distributions of the kernel density estimates appear to be very close to each other and this is confirmed by the results of Kolmogorov-Smirnov tests that we run on the hypothesis that the distributions of the balanced and unbalanced panels are the same for some key variables. The null hypothesis cannot be rejected across all tests[9]. In sum the dataset seems well suited for the purposes of the paper, because it allows us to capture diverse information on households along with the time dimension that is useful to control for the household fixed-effects.

4 The construction of an asset index

The first step in the empirical analysis is to reduce the household assets into unidimensional measures. This requires either complete knowledge of the market value of each asset owned or the construction of an asset index. Given that the prices of many assets owned by households are often unknown or difficult to determine, we construct the as-

[8]Encuesta de "Re-evaluación de localidades incorporadas en las primeras fases del Programa (1997-1998)." INSP, 2006.

[9]Not shown but available from the authors upon request.

set index using the methodology used by Adato et al. (2006): the household income[10] is regressed on the household's stock of assets. The household asset index is then the household income predicted from the estimated coefficients in the first year (1997), which are used to extrapolate to every year. The equation we estimate is of the form:

$$y_{i,t} = \beta_0 + \boldsymbol{\beta}_1 \mathbf{x}_{1i,t} + \boldsymbol{\beta}_2 \mathbf{x}_{2i,t} + STATE_i + e_{i,t}, \tag{17}$$

where $y_{i,t}$ is the per-capita income by household, $x_{1i,t}$ is a vector of household assets we are interested in, $x_{2i,t}$ is a vector of other household characteristics and STATE correspond to state dummy variables. The asset index is then constructed as

$$A_{i,t} = \hat{\boldsymbol{\beta}}_1 \mathbf{x}_{1i,t}. \tag{18}$$

The asset index is standardized by the standard deviation of itself. This simplifies the interpretation of the regression analysis results (i.e. a regression coefficient of one means one standard deviation of the index).

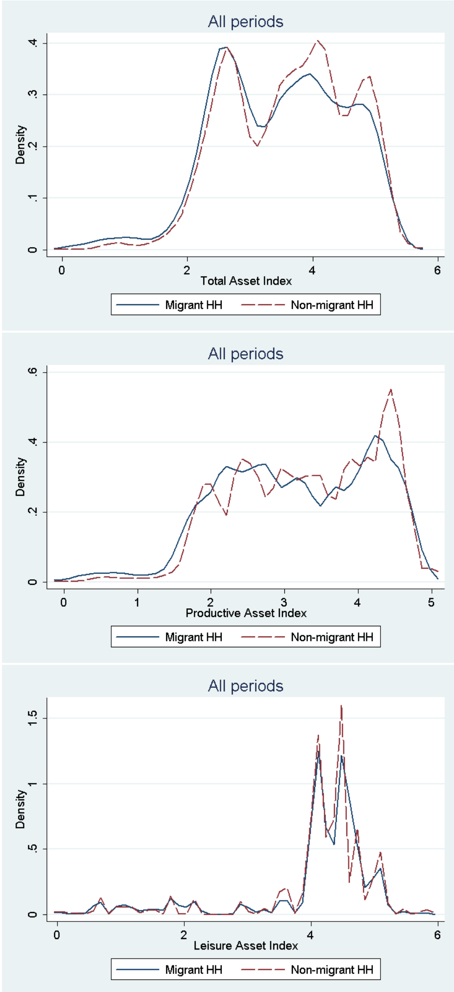
We consider three asset indexes and four categories of assets:

- A_P: Productive assets: owner of a truck, agricultural land, irrigated land, working animals;
- A_{NP}: Non-Productive (leisure) assets: ownership of radios, TV, refrigerator, gas stove, washing machine and vehicles;
- A_T: Total assets: A_P and A_{NP};
- Other dwelling and household characteristics such as: electricity, earth floor, roof weak, domestic animals, own house, years of education of the household head.

We compute the asset indexes for the different periods in the panel in Table 1. The table shows that there is a marked increase in asset accumulation for all households (HH)

[10]Income aggregates were created and broken down into five categories: agricultural wage employment, non-farm wage employment, self employment, transfers and other (including income from rent and interests).

Figure 2: Kernel density estimates for asset indexes



during the ten-year period. In Figure 2 we present density plots for migrant and non-migrant households for each type of asset. Overall, the figures show that there are no considerable differences across migrant and non-migrant HHs.

5 Descriptive statistics

According to the Bank of Mexico, Mexican migrants have remitted in 1998 an amount of income that equals approximately 1.5% of Mexican GDP. Household level surveys also show that remittances tend to play a key role on the survival and livelihood strategies for

Table 1: Asset Indexes, by HH migrant status

	All HH	**HH with migrants**	**HH without migrants**
		All years	
Asset Index	0.5	0.503	0.499
	[0.45]	[0.471]	[0.447]
Non-productive Asset Index	0.418	0.422	0.417
	[0.357]	[0.363]	[0.356]
Productive Asset Index	0.1	0.085	0.102
	[0.198]	[0.214]	[0.196]
N	13,095	1,443	11,652
		1997	
Asset Index	0.388	0.387	0.388
	[0.44]	[0.452]	[0.438]
Non-productive Asset Index	0.344	0.342	0.345
	[0.336]	[0.345]	[0.335]
Productive Asset Index	0.037	0.027	0.038
	[0.203]	[0.2]	[0.203]
		2001	
Asset Index	0.478	0.474	0.478
	[0.445]	[0.466]	[0.442]
Non-productive Asset Index	0.391	0.387	0.392
	[0.363]	[0.359]	[0.363]
Productive Asset Index	0.123	0.103	0.126
	[0.189]	[0.214]	[0.185]
		2006	
Asset Index	0.634	0.649	0.632
	[0.43]	[0.457]	[0.427]
Non-productive Asset Index	0.517	0.536	0.515
	[0.348]	[0.357]	[0.346]
Productive Asset Index	0.142	0.126	0.143
	[0.186]	[0.214]	[0.182]

many (typically rural) poor households (Rapoport et.al., 2005). We take advantage of our detailed panel database to describe the economic role played by remittances in the rural poor households. The tables below present summary statistics of the variables of interest for the balanced panel of Mexican rural households. This information is presented for the pooled database and disaggregated for the three different periods of the panel: 1997, 2001 and 2006.

We construct a dummy variable at the household level that indicates whether the household has at least one member who is a migrant (i.e., working in another locality, state or abroad). In 1997, 5% of the households had a migrant member, while 3% had a member in the US. This percentage numbers are somewhat reduced in 2001 (3% and 2%, respectively), but increase considerably in 2006 (10% and 7%, respectively). These results show that even when we follow the same households over a long period of time (10 years), there is considerable variation in migration statistics at the household level.

Table 2: Summary statistics: migration

	1997	**2001**	**2006**
Migration HH	0.05	0.03	0.10
Migration HH to the US	0.03	0.02	0.07
Number of HH	4365	4365	4365

Other summary statistics appear in Table 3. The table shows that remittances represent less than 10% of the total income in the household (0.4/7.7). Surprisingly, this ratio is very similar for households with current member/migrants and for those without (the reason for this is that remittances may come from past migrants). The (pooled) average household has a household head with 3.3 years of schooling and has 1.4 male adults in the labor force. Both schooling and labor participation increase in 2006. The table also reports community level variables that will be used as an instrumental variable in the next section. HH w/mig / #HH (at com.) is the proportion of households at the community level with at least one household member being a migrant. HH w/USmig /

#HH (at com.) represents a similar ratio but for the case when the migrant lives in the US. As explained in the next section, the instrumental variable will work well if there is enough variation both across levels and across type of households. A visual inspection of the table reveals that this is indeed the case.

Table 3: Summary Statistics

HH	**All HH**		**HH w/mig**		**HH wo/mig**	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
			All years			
Per capita inc	7.7	1.9	7.847	1.70	7.667	1.95
Remittances	0.6	3.3	1.694	8.17	0.462	1.96
Yrs educ (head)	3.362	2.079	3.977	2.23	3.271	2.45
HH male adults	1.436	1.18	1.784	1.31	1.393	1.15
#HH w/mig / #HH (at com.)	0.012	0.027	0.021	0.05	0.011	0.02
#HH w/USmig / #HH (at com.)	0.01	0.025	0.018	0.05	0.009	0.01
			1997			
Per Capita inc	7.289	2.536	7.424	2.275	7.272	2.566
Remittances	0.4	2.262	0.4	2.235	0.4	2.265
Yrs educ (head)	3.273	2.296	3.662	2.089	3.216	2.32
HH male adults	1.256	1.03	1.426	1.099	1.235	1.02
#HH w/mig / #HH (at com.)	0.011	0.031	0.018	0.05	0.011	0.028
#HH w/USmig / #HH (at com.)	0.008	0.026	0.015	0.05	0.008	0.021
			2001			
Per capita inc	7.776	1.502	7.925	1.198	7.757	1.535
Remittances	0.503	1.836	0.305	1.398	0.528	1.882
Yrs educ (head)	3.245	2.376	3.85	2.155	3.156	2.394
HH male adults	1.29	1.046	1.674	1.204	1.243	1.015
#HH w/mig / #HH (at com.)	0.008	0.021	0.015	0.049	0.007	0.013
#HH w/USmig / #HH (at com.)	0.006	0.019	0.012	0.048	0.005	0.011
			2006			
Per capita inc	7.997	1.503	8.193	1.334	7.972	1.521
Remittances	0.883	4.914	4.315	13.436	0.454	1.725
Yrs educ (head)	3.567	2.609	4.42	2.381	3.44	2.617
HH male adults	1.763	1.364	2.254	1.477	1.702	1.337
#HH w/mig / #HH (at com.)	0.017	0.029	0.029	0.068	0.015	0.019
#HH w/USmig / #HH (at com.)	0.014	0.027	0.026	0.067	0.013	0.016

6 Econometric analysis

Let A_{it} be an asset index for family i and year t. We are mostly interested in household-specific asset dynamics, that is in $G_{i,t} \equiv A_{i,t} - A_{i,t-1}$. Let $M_{i,t}$ be a variable that captures the migration-related nature of the household; X_{it} be household characteristics; and

$(\mu_i + \epsilon_{it})$ be an error component with household fixed-effects and idiosyncratic temporary shocks. We consider the following equation of asset dynamics:

$$G_{i,t} = \alpha A_{i,t-1} + \beta M_{i,t} + \delta X_{i,t} + \mu_i + \epsilon_{i,t} \tag{19}$$

We are mostly concerned with $\beta \equiv \frac{\partial E[G_{i,t}|A_{i,t-1}, M_{i,t}, X_{i,t-1}, \mu_i, \eta_t]}{\partial M}$, which denotes the conditional effect of migration on asset accumulation. We extend this analysis to a multi-dimensional measure of assets $A = \{A_P, A_{NP}\}$, where A_P denotes productive assets and A_{NP} non-productive assets. As argued above, the question we want to address here is the effect of migration on the type of assets that families accumulate.

We study the effect of migration on asset accumulation using three different measures of migration. First, we consider a dummy variable for households that declare having at least one migrant member, Migrant HH (see Table 4). Second, we use the number of migrants in the household, Number of Migrants by HH (see Table 5). Third, we use remittances per capita (see Table 6). In each case, we separately study the effect migration on: (*i*) total assets, (*ii*) productive assets, and (*iii*) non-productive assets.

6.1 Endogeneity issues

Several endogeneity issues need to be addressed in order to avoid potential biases in this estimator. First, households may respond to adverse or positive shocks (ϵ) changing the number of migrants or the nature of migration (temporal vs. permanent). Second, selection bias may occur if migrant households are intrinsically different from non-migrant ones.[11] Acosta (2006) uses migration networks and history (at the village or household level) as instruments for migration (or remittances) postulating that these variables have a positive impact on the opportunity to migrate but no additional impact on income, schooling, or nutrition at home. McKenzie and Sasin (2007) argue that these instruments are suitable to study the migration impact at the originary location as it is our case.

[11]Regarding the relationship between migration and self-selection, Borjas (1987, 1991) has formalized the endogeneity of the migration decision, showing that the welfare impact of immigrants is crucially dependent on the degree of transferability of their unobservable and observable variables, and that affects the labour market.

Following previous work on this subject, the IV strategy we follow uses the percentage of migrants (to all destinations and to the US) at the community level as an instrument for the household level decision. The Sargan test for overidentification in the following tables has an average p-value of 0.1 for total and productive assets, and 0.4 for non-productive assets. As a result they do not reject the null hypothesis of exogeneity of the instrumental variable. Moreover, both instruments are significant on the first stage of the regression with high F-values.

Table 4: Growth of the Asset Index - Migrant Household

	(1)	(2)	(3)
	OLS	FE	IV-FE
ALL ASSETS			
Asset Index$_{t-1}$	-0.569***	-1.334***	-1.357***
	(0.00986)	(0.0126)	(0.0154)
Migrant HH	-0.140***	0.0601	0.827***
	(0.0414)	(0.0455)	(0.279)
HH male adults	-0.0715***	0.0836***	0.0607***
	(0.00783)	(0.0128)	(0.0156)
R^2	0.282	0.729	0.712
Sargan Test			0.0942
First Stage F-Test			63.81
PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.553***	-1.349***	-1.367***
	(0.00981)	(0.0125)	(0.0148)
Migrant HH	-0.136***	0.0596	0.689***
	(0.0413)	(0.0444)	(0.267)
HH male adults	-0.0799***	0.0538***	0.0347**
	(0.00781)	(0.0125)	(0.0151)
R^2	0.274	0.738	0.726
Sargan Test			0.0965
First Stage F-Test			64.87
NON PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.657***	-1.491***	-1.485***
	(0.0120)	(0.0161)	(0.0165)
Migrant HH	-0.135***	-0.162***	-0.678**
	(0.0467)	(0.0543)	(0.300)
HH male adults	-0.0516***	-0.0304**	-0.0113
	(0.00885)	(0.0150)	(0.0187)
R^2	0.258	0.664	0.657
Sargan Test			0.434
First Stage F-Test			75.36
Observations	8.730	8.730	8.730
Households		4.365	4.365

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. See text for variable definitions.

6.2 Second stage

In all cases the OLS effect of migration on assets accumulation is negative and statistically significant. However, when we include the household-level FE this effect becomes non-significant, except for non-productive assets where it continues to display a negative sign and significant. The fixed-effects results also show that total and productive assets may have a positive correlation with migration. The differences between OLS and FE are in line with those outlined before in Section 2. Comparing (13) with (14) shows that the effect of FE should be bigger than that of OLS.

Next, we follow the IV strategy described above. Both total assets and productive assets become positive and statistically significant while non-productive assets is, in general, negative and statistically significant. A striking feature here is actually the magnitude of the effect. The coefficient of the migrant dummy variable can be interpreted as the change in standard deviation units of the corresponding asset. Therefore this shows that having a migrant household increases total asset accumulation by 0.8 standard deviation units. Moreover, one additional household migrant contributes to 0.2 total assets standard deviation units. Finally, doubling the amount of remittances per capita increases assets by 1.2/10 of a standard deviation.

The magnitude and sign of the effect on productive assets follow closely that of total assets. Having a migrant household increases productive asset accumulation by 0.8 standard deviation units. Moreover, one additional household migrant contributes to 0.2 total assets standard deviation units. Finally, doubling the amount of remittances per capita increases assets by 1/10 of a standard deviation. However, there is a negative and statistically significant effect on non-productive asset accumulation of a similar magnitude. We consider that the negative coefficient in non-productive assets is also an interesting result in itself. It suggests that some families with migrants reduce their spending in non-productive asset so as to leave additional funds available for the accumulation of productive assets. This result can in fact be related to our model in Section 2. There, we have shown the existence of a minimum initial level of wealth that is necessary to hold in

Table 5: Growth of the Asset Index - Number of Migrants by Household

	(1) OLS	(2) FE	(3) IV-FE
ALL ASSETS			
Asset Index$_{t-1}$	-0.569***	-1.333***	-1.357***
	(0.00986)	(0.0125)	(0.0158)
Number of Migrants by HH	-0.0290***	0.00847	0.220***
	(0.00911)	(0.0101)	(0.0768)
HH male adults	-0.0703***	0.0841***	0.0510***
	(0.00790)	(0.0129)	(0.0180)
R^2	0.282	0.729	0.702
Sargan Test			0.0812
First Stage F-Test			41.93
PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.554***	-1.348***	-1.367***
	(0.00981)	(0.0124)	(0.0150)
Number of Migrants by HH	-0.0299***	0.00826	0.182**
	(0.00909)	(0.00982)	(0.0732)
HH male adults	-0.0784***	0.0543***	0.0266
	(0.00788)	(0.0126)	(0.0174)
R^2	0.274	0.738	0.719
Sargan Test			0.0844
First Stage F-Test			42.80
NON PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.657***	-1.491***	-1.483***
	(0.0120)	(0.0161)	(0.0169)
Number of Migrants by HH	-0.0211**	-0.0281**	-0.186**
	(0.0103)	(0.0120)	(0.0820)
HH male adults	-0.0516***	-0.0312**	-0.00241
	(0.00893)	(0.0151)	(0.0213)
R^2	0.258	0.663	0.650
Sargan Test			0.480
First Stage F-Test			49.78
Observations	8.730	8.730	8.730
Households		4.365	4.365

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. See text for variable definitions.

Table 6: Growth of the Asset Index - Remittances per capita

	(1)	(2)	(3)
	OLS	FE	IV
ALL ASSETS			
Asset Index$_{t-1}$	-0.570***	-1.334***	-1.352***
	(0.00986)	(0.0125)	(0.0155)
Remittances per capita	0.000863	0.00849**	0.124***
	(0.00341)	(0.00378)	(0.0447)
HH male adults	-0.0750***	0.0841***	0.0660***
	(0.00776)	(0.0128)	(0.0157)
R^2	0.281	0.729	0.671
Sargan Test			0.117
First Stage F-Test			19.05
PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.554***	-1.348***	-1.362***
	(0.00982)	(0.0124)	(0.0147)
Remittances per capita	0.000579	0.00608*	0.104**
	(0.00340)	(0.00369)	(0.0423)
HH male adults	-0.0833***	0.0546***	0.0390***
	(0.00774)	(0.0125)	(0.0150)
R^2	0.274	0.738	0.696
Sargan Test			0.115
First Stage F-Test			19.42
NON-PRODUCTIVE ASSETS			
Asset Index$_{t-1}$	-0.658***	-1.492***	-1.481***
	(0.0120)	(0.0161)	(0.0177)
Remittances per capita	-0.0122***	-0.00499	-0.104**
	(0.00384)	(0.00453)	(0.0480)
HH male adults	-0.0553***	-0.0354**	-0.0163
	(0.00877)	(0.0149)	(0.0182)
R^2	0.258	0.663	0.626
Sargan Test			0.454
First Stage F-Test			21.75
Observations	8.730	8.730	8.730
Households		4.365	4.365

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. See text for variable definitions.

order to invest. Families at the margin of $y = R/(R-1)$, who now choose to invest as a consequence of the migration phenomena, may reinforce the magnitude of their project by concomitantly reducing consumption.[12]

Overall the results show that migration can be seen as a long-term investment for the household. Therefore, the income sent back home by the migrant is used to accumulate productive assets, rather than non-productive assets. These findings appear across all the different specifications presented in the tables.

7 Conclusion

This paper aims at explaining the link between migration and asset dynamics for a panel of poor rural households in Mexico over the period 1997-2006. Our results suggest that migration may be used by households as a mechanism to accelerate asset accumulation in productive assets. The general idea is that remittances may help alleviate credit constraints for poor households, thus allowing them to invest in productive assets that would be optimal under complete markets. Furthermore, our estimations also suggest that families who send migrants with the intention to channel remittances towards investment in productive assets, concomitantly reduce their accumulation of non-productive assets, possibly to further contribute to raising funds for physical investment.

An important caveat concerning our analysis is that it has abstracted from general equilibrium interactions, so as to focus exclusively on the direct effect of migration on capital accumulation via remittances. One specific general equilibrium effect that may be particularly relevant in our context is the fact that migration decisions will necessarily affect the aggregate labor supply at the home village. On the one hand, migration lowers aggregate labor supply at the village level, which in turn would raise equilibrium wages and household incomes (see Jaimovich (2010) for a growth model where this mechanism

[12]Strictly speaking, this does not occur in our (highly) stylized model because we assume that $\upsilon \geq 1$ [see equation (8)] together with a fixed level of investment. However, letting $\upsilon > 0$ would straightforwardly lead to the result that households at the margin of $y = R/(R-1)$ will reduce consumption to help raising funds for investment, when the migrant finds a good job and $0 < \upsilon < 1$.

is at play). However, looking at the household level, sending out a migrant also means losing one of their workers (and, possibly, the most productive worker). Furthermore, it may well be the case that the wealth effect brought about by the migrant leads household members who remain at the village to increase their leisure consumption. In that regard, two remarks apply here. First, although we acknowledge that these effects imply that migration may influence accumulation also by other channels other than remittances, we are agnostic concerning the overall sign of these additional effects. Second, the above general equilibrium effect on the wage, which could be expected to induce an upwards bias on the effect of remittances, will be of significant magnitude only if the *total* number of migrants from the rural village varies substantially across our years of observations. In that respect, the results in Table 2 are not so discouraging, as they tell us that the percentage of families with at least one migrant ranges within 3% to 10% of the sampled households.

References

Acosta P. (2006) "Labor Supply, School Attendance, and Remittances from International Migration: The Case of El Salvador," World Bank Policy Research Working Paper N.3903.

Adato, M., Carter, M.R. and May, J. (2006) "Exploring poverty traps and social exclusion in South Africa using qualitative and quantitative data," *Journal of Development Studies* 42:2, 226 - 247.

Banerjee, B. and Bucci, G. A. (1994) "On-The-Job Search After Entering Urban Employment: An Analysis Based On Indian Migrants," *Oxford Bulletin Of Economics And Statistics* 56, 1, 33-47.

Borjas, G. J. (1987) "Self-Selection And The Earnings Of Immigrants," *American Economic Review* 77, 4, 531-53.

Borjas, G. J. (1991) "Immigration And Self-Selection," *in Abowd and Freeman* 27-96.

Carter, M. R. and Barrett C. (2006) "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach," *Journal of Development Studies* 42, 178-199.

Das Gupta, M. (1987) "Informal Security Mechanisms and Population Retention in Rural India," *Economic Development and Cultural Change* 36, 101-120.

Durand, J. and Massey D. S., (2001) "Mexican Migration to the United States: a critical review," *Latin American Research Review* 27, 3-42.

Ghatak, S., Levine, P. and Wheatly Price, S. (1996) "Migration Theories and Evidence: An Assesment," *Journal of Economic Surveys* 10, 159-198.

Giuliano, Paola and Ruiz-Arranz, Marta, (2009) "Remittances, financial development, and growth," *Journal of Development Economics* 90, 144–152.

Glytsos, N. P. (1993) "Measuring The Income Effects of Migrant Remmittances: A Methodological Approach Applied to Greece," *Economic Development and Cultural Change* 42, 131-168.

Hanson, G.H. and Woodruff, C. (2003) "Emigration and Educational Attainment in Mexico," mimeo.

Harris, J.R. and Todaro, M.P. (1970) "Migration, Unemployment And Development:

A Two-Sector Analysis," *American Economic Review* 60, 126-142.

Jaimovich, E. (2010) "Adverse Selection and Entrepreneurship in a Model of Development," *Scandinavian Journal of Economics* forthcoming 112, March 2010.

Lewis, W.A. (1954) "Economics Development With Unlmimited Supplies Of Labor," *Manchester School of Economic and Social Studies* 22, 139-191.

Lucas, Robert E. B. and Stark, O. (1985) "Motivations to Remit: Evidence from Botswana.' *Journal of Political Economy* 93: 901-918.

McKenzie, D. and Sasin, M.J. (2007) "Migration, Remittances, Poverty, and Human Capital: Conceptual and empirical challenges," World Bank Policy Research Working Paper N.4272.

McKenzie, D. and Woodruff, C. (2006) "Do entry costs provide an empirical basis for poverty traps? Evidence from Mexican microenterprises," *Economic Development and Cultural Change* 55, 3-42.

Mesnard, A. (2004) "Temporary migration and capital market imperfections," *Oxford Economic Papers* 56, 242–262.

Mesnard, A. and Ravallion, M. (2006) "The wealth effect on new business startups in a developing economy," *Economica* 73, 367–392.

Molle, W. and Van Mourik, A. (1988) "International movements of labour under conditions of economic integration: the case of Western Europe," *Journal of Common Market Studies* 26, 317-42.

Munshi K. (2003) "Networks in the modern economy: Mexican Migrants in the U.S. Labor Market," *Quarterly Journal of Economics* 118, 549-599.

Montgomery, James. (1991) "Social Networks and Labor-Market Outcomes: Toward an Economic Analysis," *American Economic Review* 81, 1408–1418.

Rapoport, Hillel and Frédéric Docquier, (2005) "The Economics of Migrants' Remittances", IZA Discussion Paper No. 1531, chapter prepared for the Handbook on the Economics of Reciprocity, Giving and Altruism, Elsevier- North Holland, forthcoming (Editors: L.-A. Gerard-Varet, S.-C. Kolm and J. Mercier-Ythier).

Rapoport, Hillel, (2002) “Migration, credit constraints and self-employment: A simple model of occupational choice, inequality and growth.” *Economics Bulletin* 15, 1-5

Rozelle, S. and Taylor J. E. and DeBrauw A. (1999) “Migration, Remittances, and Agricultural Productivity in China,” *American Economic Review* 89, 287-291.

Sen, Amartya K. (1966) ”Peasants and Dualism with or without Surplus Labour,” *Journal of Political Economy* 74, 425-450.

Stark, O. (1991) “The Migration Of Labor,” *Cambridge, Mass.: Basil Blackwell*

Woodruff, C. (2001) “Remittances and Microenterprises in Mexico,” mimeo.

Appendix

Proof of Proposition 1.

Step 1: Let $y_i \in \left[\frac{R}{R-1}, \overline{y}\right]$ and define:

$$\widetilde{n}_1(y_i) \equiv \frac{M}{\ln(y_i + \upsilon - 1) - \ln(y_i - 1)}. \tag{20}$$

Notice first that $\widetilde{n}_1(y_i) > 0$ and finite, since both the numerator and denominator in (20) are strictly positive and finite. Secondly, differentiating (20) with respect to y_i yields:

$$\frac{d\widetilde{n}_1}{dy_i} = \frac{M}{[\ln(y_i + \upsilon - 1) - \ln(y_i - 1)]^2}\left(\frac{1}{y_i - 1} - \frac{1}{y_i + \upsilon - 1}\right) > 0,$$

where the result $\widetilde{n}_1'(y_i) > 0$ follows from the fact that $y_i - 1 < y_i + \upsilon - 1$. Finally, since the left-hand side in (7) is strictly increasing in n_i, it immediately follows that for any $n_i > \widetilde{n}_1(y_i)$ condition (7) holds.

Step 2: Let $y_i \geq 1$ and $y_i \in \left(\widehat{y}, \frac{R}{R-1}\right)$ and define:

$$\widetilde{n}_2(y_i) \equiv \frac{M}{\ln(y_i + \upsilon - 1) + \ln(y_i + R) - \ln(y_i^2)}. \tag{21}$$

Firstly, $\widetilde{n}_2(y_i) > 0$ and finite, because both the numerator and denominator in (21) are strictly positive and finite. Secondly, differentiating (21) with respect to y_i yields:

$$\frac{d\widetilde{n}_2}{dy_i} = \frac{M}{[\ln(y_i + \upsilon - 1) + \ln(y_i + R) - \ln(y_i^2)]^2}\left(\frac{2}{y_i} - \frac{2y_i + R + 2(\upsilon - 1)}{y_i^2 + R(y_i - 1) + y_i(\upsilon - 1) + \upsilon R}\right) > 0, \tag{22}$$

where $\widetilde{n}_2'(y_i) > 0$ obtains after some algebra on the second term in right-hand side of (22), which leads to the condition that $\widetilde{n}_2'(y_i) > 0$ iff $y_i(R-1) + y_i\upsilon + 2R(\upsilon - 1) > 0$. Lastly, since the left-hand side in (11) is strictly increasing in n_i, it immediately follows that for any $n_i > \widetilde{n}_2(y_i)$ condition (11) prevails.

Step 3: Let $y_i \geq 1$ and $y_i \leq \widehat{y}$ and define:

$$\widetilde{n}_3(y_i) \equiv \frac{M}{\ln\left(y_i + \frac{\upsilon}{2}\right)^2 - \ln(y_i^2)}. \tag{23}$$

As in the previous two cases, $\widetilde{n}_3(y_i) > 0$ and finite, as both the numerator and denominator in (23) are strictly positive and finite. Next, differentiating (23) with respect to y_i yields:

$$\frac{d\widetilde{n}_3}{dy_i} = \frac{M}{\left[\ln\left(y_i + \frac{\upsilon}{2}\right)^2 - \ln\left(y_i^2\right)\right]^2}\left(\frac{2}{y_i} - \frac{2y_i + \upsilon}{y_i^2 + \frac{\upsilon^2}{4} + y_i\upsilon}\right) > 0, \tag{24}$$

where $\widetilde{n}_3'(y_i) > 0$ obtains after some algebra on the second term in right-hand side of (24), which leads to the condition that $\widetilde{n}_3'(y_i) > 0$ iff $\frac{\upsilon^2}{2} + y_i\upsilon > 0$. Finally, since the left-hand side in (12) is strictly increasing in n_i, it trivially follows that for any $n_i > \widetilde{n}_3(y_i)$ condition (12) holds.

Step 4: Let now,

$$\widetilde{n}(y_i) = \begin{cases} \widetilde{n}_1(y_i) & \text{if } \frac{R}{R-1} \leq y_i \leq \overline{y}, \\ \widetilde{n}_2(y_i) & \text{if } y_i \geq 1 \text{ and } \widehat{y} < y_i < \frac{R}{R-1}, \\ \widetilde{n}_3(y_i) & \text{if } y_i \geq 1 \text{ and } y_i \leq \widehat{y}. \end{cases}$$

Replacing $y_i = \frac{R}{R-1}$ into (20) and (21), we can observe after some simple algebra that $\widetilde{n}_1\left(\frac{R}{R-1}\right) = \widetilde{n}_2\left(\frac{R}{R-1}\right)$. Similarly, from the definition of $\widehat{y}$ in (10), replacing $y_i = \widehat{y}$ into (21) and (23), it follows that $\widetilde{n}_2\left(\widehat{y}\right) = \widetilde{n}_3\left(\widehat{y}\right)$. As a consequence, it follows that $\widetilde{n}(y_i)$ portrays a continuous and strictly increasing function and $\widetilde{n}(y_i) : \mathbb{R}_{++} \to \mathbb{R}_{++}$.

Step 5: Finally, to prove that $\widetilde{n}\left(\frac{R}{R-1}\right) < 1$, notice that plugging $y_i = \frac{R}{R-1}$ into (20) leads to:

$$\widetilde{n}_1\left(\frac{R}{R-1}\right) = \frac{M}{\ln\left(\frac{1}{R-1} + \upsilon\right) - \ln\left(\frac{1}{R-1}\right)} = \frac{M}{\ln\left(\frac{\frac{1+\upsilon(R-1)}{R-1}}{\frac{1}{R-1}}\right)} = \frac{M}{\ln\left[1 + \upsilon(R-1)\right]}.$$

Therefore, $\widetilde{n}_1\left(\frac{R}{R-1}\right) < 1$ iff $M < \ln\left[1 + \upsilon(R-1)\right]$, which is guaranteed by $M \leq \ln(R)$ together with $\upsilon \geq 1$ and $R > 1$. ■